

## **Chair's Summary of Program Review of Protected Species Science**

Alaska Fisheries Science Center  
7600 Sand Point Way N.E., Building 4  
Seattle, Washington 98115  
16 – 20 March 2015

### **Review Panel Members:**

- Jim Harvey - Chair (Moss Landing Marine Laboratories)
- Laura Cowen (University of Victoria)
- Mike Simpkins (Northeast Fisheries Science Center)
- John Stein (Northwest Fisheries Science Center)
- Mike Tillman (Scripps Institution of Oceanography)

### **Background and Overview of Meeting**

#### General Observations and Recommendations:

The Review Panel reviewed the activities of the protected resources program in Alaska, which are the marine mammal studies of the National Marine Mammal Laboratory (NMML) at the Alaska Fisheries Science Center. The Panel generally considers NMML to be a very productive unit that is providing good science needed by the Regional Office, especially considering the difficulties of data collection in such a large and dynamic environment as Alaska. NMML has an excellent combination of very capable field scientists with an impressive group of quantitative scientists that add substantially to the efforts. A lack of adequate funding has restricted the number of projects that can be accomplished, yet the NMML has been effective at garnering external funds, especially from BOEM (Bureau of Ocean Energy Management). There are a number of species and stocks that are of concern because of a minimal population size or because trends indicate substantial declines. For some of these species/stocks (e.g., North Pacific right whales, Cook Inlet beluga, western Aleutian Steller sea lions and harbor seals) there is uncertainty in the population sizes and trends because of a lack of sufficient data due to minimal or no financial resources for surveys. An apparent strength is the high degree of coordination between the Center and the Alaska Regional Office in long- and short-term planning. For example, the Region's list of top ten marine mammal priorities identifies the science required to backstop its current and future management needs. By the same token, however, the Center Director's annual guidance document does not explicitly cross-walk with the Region's list. Such a cross-walk would be a valuable tool to assist any future reviewers when judging the relevance of the science and research undertaken. NMML also has shown evidence of communicating their research to the wider public, for example, via pamphlets and videos.

## Panel Member's Major Recurrent Observations and Recommendations

The listed observations and recommendations below are not in any specific order and do not represent consensus but represent the general views of the panel or the views of individuals.

### **Theme 1: Information Needs**

#### Observations:

The types of information needed to make sound management decisions are developed via a process that involves the individual scientists preparing activity plans that are prioritized within the Center, the Regional Office establishing the data needs of the agency, and then at least one joint meeting of the region and science center staff discussing the intended plan. There also are in-year meetings to discuss changes in priorities and spending plans. This type of coordination is essential and seems to work well in this region.

Clearly the most important data needs are for precise and accurate stock assessments (e.g., abundance and trends). These data are needed to determine PBR (potential biological removal) and inform recovery strategies, listings, and other management issues associated with human activities. Secondly, data needs include an understanding of the causes of declines or limitations to recovery. The third most important data need involves anthropogenic effects, which include such issues as harvests, contaminants, ship strikes, disturbance, fisheries interactions, and acoustic impacts. The effects of bycatch or noise were not reported often during this review but were considered important by the Regional Office.

#### Strengths:

- Strong partnership with other NOAA science centers and the Alaska regional office, and outside agencies, especially BOEM.
- Excellent core of scientists with expertise in sample design, survey techniques, modeling, and interpretation.
- Formal and informal implementation process to adapt research priorities in coordination/consultation with the Regional Office.
- The burgeoning use of acoustics for surveying and detection, and impacts of acoustic sources of disturbance have been recognized, and NMML has sought expertise in bioacoustics.
- Successful incorporation and development of instrumentation into the science.

#### Challenges:

- Lack of consistent NOAA funding that restricts data gathering; and external sources of funding, especially from ADFG, are decreasing or are variable.

- Increasing and stabilizing the proportion of NOAA funding, presently about 16% of the NMML total expenditures for research are from external (reimbursable) sources.
- Significant gaps between mandated stock assessments and Center's ability to produce those assessments. Many stocks do not have population or mortality estimates, and many that do have very outdated information.
- Gaps in data for stock assessments are largely explained by resource limitations and significant (and costly) logistical challenges to assessing many of these stocks. Some aspects of this gap also may be related to lack of flexibility within federal line-items to support assessments of stocks that are not well funded by directed line-items (i.e., PPAs).
- Fisheries observer coverage for Alaska state fisheries has always been very poor, and has now been canceled entirely. This is problematic for assessing bycatch for harbor porpoise, Dall's porpoise, seals, etc., that are vulnerable to bycatch particularly in gillnet fisheries.
- Harvest monitoring has been carried out via co-management agreements and through Alaska Department of Fish and Game. State of Alaska support for that work is apparently declining, which is problematic for assessing directed mortality of harvested stocks.
- Significant cost in terms of scientific labor, and associated ability to carry out research, associated with intermittent need to respond to listing petitions (e.g., recent ice seal listing petitions required NMML staff time that might otherwise have been spent carrying out ice seal research).
- Funding for the top 10 priorities, as presented by NMML, is difficult.
- Research Permits not being received in a timely manner to allow research when necessary.

Recommendations to address issue:

- The Research Permit process needs to improve so that permits can be approved more rapidly with greater involvement in decision making by grantees.
- There needs to be a more transparent mechanism for making decisions on funding priorities. Although there seems to be good communication between the Science Center and the Regional Office, the panel was uncertain the mechanisms in place to determine and fund priorities.
- Consider developing a bit more formal process to cross-walk management needs and science activities at the Center. Explore alternative approaches to providing advice to managers related to stocks that are particularly difficult to assess and/or unlikely to receive sufficient funding support to assess (i.e., alternatives to full-blown population and mortality assessments with associated PBR evaluation).
- Develop explicit strategy for assessing all stocks, considering costs, likely available funds, and scientific and management priorities. This could include alternative options for providing advice to managers, and a discussion of alternatives to PBR for management issues.
- Pursue support for bycatch and harvest monitoring in particularly risky fisheries and/or regions.

- More coordination among programs to allow piggy-backing among NMML programs or other funded projects in the area.
- Because the current 5-year plan lapses at the end of 2015, the Region and Center should review and revise the plan as needed for application to the 2016-2020 period, as well as reconsider the list of high priority information needs.
- The Center should review the list of out-of-dated estimates of abundance used for PBR assessments, determine their priority order, and work with the Region to develop the means for updating them.

## **Theme 2: Otariid Pinniped Science**

### **Observations:**

The primary issue associated with pinnipeds, and otariids in particular, is the rapid and large-scale decline in stocks of Steller sea lion and northern fur seals in the Aleutians and Pribilof Islands. Given the spatial scale of the decline, it would argue for some environmental perturbation that affected numerous species. It is unfortunate that with many millions of dollars spent that we are not much closer to understanding the root cause of this decline. Some hypotheses regarding the decline have been studied and likely are not contributing substantially to the decline, whereas others have not or cannot be fully examined.

### **Strengths:**

- A reasonably good baseline exists for counts, condition, diet, and other variables that will allow comparison with future studies. Basic abundance (using pup counts with a correction factor) and trend monitoring is being carried out and this clearly needs to continue.
- Science is well targeted to addressing management needs.
- Strong population dynamics and vital rates program.
- Strong tagging and movement/habitat analysis program (particularly Northern fur seal program because fur seals show more clear habitat associations).
- Strong analytical capabilities, with particular reference to development of AgTrend analytical tool. Statisticians have developed statistical methods to deal with missing count information from sites that were missed for logistical reasons.
- Have good mark-resight information (beginning in 2000) on the eastern population of Steller sea lion. This will provide excellent comparison data to the western and central Aleutian populations.
- For northern fur seals, there is a lengthy historical database, including bull counts from the 1900s and pup counts from the late 1940s.
- Strong record of publications.
- Development of a new set of sampling methodologies, such as remote cameras at rookeries, aerial survey cameras, and use of cameras on UASs (Unmanned Aircraft Systems).
- Clearly substantial planning and priority setting to adapt to changing needs and changing resource/logistical issues.

- Good coordination with partners, including State, Russia, academics, and Alaska Native Organizations (at least for fur seals, work with ANOs with respect to sea lions not discussed).
- Good efforts to communicate with public via Seattle Aquarium and video.
- Timely delivery of several products to Regional Office and Fishery Management Council.
- Mark-resight studies in the western Aleutians have begun but it is too early to obtain age-class survival information and birth/recruitment rates. Permanent marks are used so there are no tag-loss issues.

#### Challenges

- Complex systems and very difficult to tease out causes of population trends.
- Strong political pressures to focus on particular questions and products.
- Lack of data from the Western and Central Aleutians. Given the disparate recovery responses of Western-Central Aleutian populations of Steller sea lions versus Eastern Aleutian-Gulf of Alaska stocks, there is need to enhance recently started research efforts in the Western-Central Aleutians.
- Lack of data from Bogoslof Island for northern fur seals. Given the disparate recovery response of Bogoslof Island versus St. Paul and St. George Islands, there is need to enhance recently started research efforts on Bogoslof Island.
- Assessing the potential interaction between Steller sea lions and fisheries in the western Aleutians is compromised by the variability in estimates of fish stocks in the region.
- The correction factor for Steller sea lions is 25 years old, and it is not known if it is still valid, especially with an unstable population in decline. This correction factor comes with the assumption that population declines over all groups are equal (males, female, juvenile, pups); this assumption needs to be assessed.
- There are permit issues regarding the capture of adult female sea lions restricting the marking to pups. This has led to delays in research projects and findings.

#### Recommendations to address issue:

- Greater collaboration with Native Alaskan hunters to provide additional samples to assess vital rates, contaminants, and disease.
- Continue population monitoring and vital rates (marking and resighting) work for Steller sea lions and northern fur seals.
- Continue to invest a reasonable portion of resources in investigating causes of population dynamics of Steller sea lions, with goal of striking good balance between monitoring current status and improving understanding, which in turn should identify ongoing or developing management issues.
- For Steller sea lions, the Center should urgently continue and strengthen its research efforts in the Western and Central Aleutians, paving the way for comparative studies of the very different recovery response in these two areas. Such comparative studies might give new insights into the factors controlling Steller sea lion population dynamics.

- Given flexibility in use of pinniped funding, NMML should consider relative priorities (in terms of science and management) for research spending among the pinniped research programs. For example, given lack of information on ice seals and climate and development threats facing those species, some resources might be shifted to ice seal research from the traditionally better-funded otariid programs.
- Leverage resources by conducting joint Steller sea lion, northern fur seal, harbor seal, and killer whale (and perhaps other species as well) research efforts in Western Aleutian Islands.
- Check the correction factor on the eastern population of Steller sea lions using a Jolly-Seber model to get a second estimator of abundance. Once at least 3 years of mark-resight data have been collected, a Jolly-Seber model can be used to obtain an abundance estimate of the pups as well as survival information. Once this study has been ongoing to include different age classes and sex, this will be extremely useful to evaluate the abundance estimator as well as provide the survival rate estimation that is lacking.
- For northern fur seals, the Center should continue and enhance its research efforts at Bogoslof Island, making possible comparative studies of the disparate recovery response of this population and giving insights into the population dynamics of northern fur seals.
- Regarding Steller sea lion and northern fur seal, the Center should continue its examination of hexacopters and other UASs given their relative low cost and applicability to difficult weather/terrain situations.
- Given that populations of Steller sea lions and harbor seals west of 177 ° are not recovering, we suggest conducting a study to determine the differences in environmental conditions between the region west and east of 177 ° in the Aleutians.

### **Theme 3: Phocid Pinniped Science**

#### **Observations:**

Investigations of ice seals, in particular, are relatively new and less well funded compared with studies of Steller sea lions and northern fur seals. Because of the large spatial scales and widespread distribution, ice seals have been difficult and expensive to assess; hence there are limited data to determine population size and trends. These surveys also have relied on non-NOAA (BOEM) funding, hence sampling is less consistent, and past support by ADFG has waned. The ice seals are especially vulnerable to changing sea ice conditions associated with global warming. The populations of interest include the Iliamna Lake and western Aleutian harbor seals, and ice seals.

#### **Strengths:**

- Research targeted to addressing management needs, though significantly constrained by resources.

- Good coordination with BOEM, Alaska Native groups, State, and academics – including statewide research plans for phocids.
- Using a Bayesian spatial hierarchical regression model with covariates to obtain estimates of abundance, making good use of the statisticians involved.
- Development of new aerial photographic techniques combining infrared and digital cameras has greatly increased the capabilities for surveying.
- New tags and tagging techniques combined with robust statistical modeling on animal movements have provided critical data on haul-out habits, movements, and diving behavior that inform habitat use and assessment.
- Concentration of survey effort for harbor seals in areas of greatest abundance or areas of greatest importance (e.g. western Aleutians).
- Improved harbor seal abundance estimation analyses with increased precision, which in turn avoids unnecessary restrictions on subsistence harvest (i.e., higher PBR values).

#### Challenges:

- With 12 different stocks of harbor seals with great spatial dispersion the ability for proper assessments and assignment of stock structure is impacted, especially as it relates to localized harvests and PBR.
- Difficult and expensive to assess harbor seals in the western Aleutians and ice seals in the Arctic, critical areas considering decreased numbers in some areas. Population abundance estimates in the western Aleutians have lesser precision because of poor sample size and detection issues. Also species identification of ice seals is sometimes difficult using aerial survey methods.
- Minimal amounts of critical information to inform the consideration of listing Iliamna Lake harbor seals (e.g., genetic structure and population dynamics largely unknown).
- The large amount of data collected using satellite-based tags requires large amounts of processing time; hence the need for additional persons to analyze the data or need for better automated processing.
- Difficult to link population dynamics to causes (e.g., understanding likely impact of loss of sea ice on ice seals).
- Spatial use data has not been linked to environmental data to identify habitat associations- this will affect where data collection is focused on future surveys.

#### Recommendations to address issue:

- Recommend the hiring of a data manager for this program to help manage the large and increasing datasets.
- Continued funding and improvements of aerial assessments to produce abundance estimates at the appropriate intervals, especially for ice seals. Continue efforts to automate detection capabilities via FLIR data.
- Continue to fund the satellite tagging efforts, especially of ice seals, to improve data on assessments, movements, and habitat use.

- Finish ice seal abundance estimates and update SARs.
- Conduct Chukchi/Beaufort surveys for ice seals, particularly important for ringed and bearded seals.
- Link ice seal survey and tracking data to habitat variables to investigate habitat preferences, potential areas of special importance, and possible impacts of loss of sea ice.
- Investigate PCOD (Population Consequences of Disturbance) work on harbor seals and other species and consider similar approaches to estimating impacts of disturbance on seals (e.g., cruise ships in glacial fjords).
- Consider implementing a rotating panel survey design. Panel surveys reduce variances estimates compared with traditional designs. Also important that non-priority colonies be surveyed to capture any shifts in habitat use.
- Collaborate with cruise ships (perhaps user fees for example) to begin research on the effects of cruise ships on harbor seals. Ideally a BACI design would be implemented here.
- The Center should work with OMAO to obtain a King Air aircraft that would increase the safety and other capabilities of the aerial surveys.
- The Center should consider using the Ice Seal Committee to address the issue of coordinating satellite tagging efforts.
- The Center should pursue with the USFWS undertaking a possible polar bear aerial survey in the Chukchi Sea, applying NMML's camera system and data analysis, and leveraging that to get ice seal data as well.

#### **Theme 4: Large Cetacean Science**

##### **Observations**

The most disconcerting aspect of this research program is the complete lack of NOAA funding for large cetacean research. This is particularly troubling given that one of the most threatened species, the North Pacific right whale, is not being assessed. There is concern that shipping lanes will open up in the Arctic due to melting sea ice, which likely will put large whales at risk as they pass through this area.

##### **Strengths:**

- Ingenuity collecting data to address management needs in spite of lacking financial resources from NOAA.
- Excellent broad-scale, multi-year research programs (ASAMM, CHAOZ, ARCWEST), supported through strong partnership with BOEM.
- Long time series of bowhead data via ASAMM and predecessor programs.
- Good partnerships with Alaska native organizations, academics, Canada, etc.
- Strong acoustic program, using passive acoustic recorders.
- SPLASH program was great and products continue to follow.
- Tag impacts study very helpful, and rarely done.
- Very strong publication record.
- Timely reporting from ASAMM program.



- Commitments by leadership and staff to collaboration and multi-disciplinary studies. These views make possible access to expertise, datasets and assets that otherwise would not be available, as well as a commendable publication record.

#### Challenges:

- Assessing North Pacific right whales will require a great deal of vessel or aerial survey effort because there are few (maybe 30 individuals), and they are widely dispersed and more offshore than previously expected. No good population estimate for the western population of right whales, collaborations with Russian to study this will likely be difficult.
- Lack of internal NOAA funding requires reliance on external funding, which can be less dependable.
- Several stocks with uninformative (e.g., missing or out of date data) stock assessments – resulting from lack of resources to carry out research.
- A 7-8 year dataset from the passive acoustic recorders already exists that has not yet been fully analyzed and could be mined for information on habitat use.

#### Recommendations to address issue:

- Recommended funding for a wide-scale vessel survey of the Bering Sea and Gulf of Alaska that would provide estimates for North Pacific right whales but also many marine mammals in this region. This would allow photo-ID, tagging, and other dedicated operations when right whales were observed.
- Need support to allow recovery and redeployment of passive acoustic monitoring of cetaceans in the Bering Sea, Chukchi, and Beaufort Seas. Excellent and irreplaceable source of information.
- Recommend support by NOAA to finish the genetic samples of humpback whales collected during the SPLASH project.
- Continue broad-scale, multi-year research programs – especially ASAMM given its long time series and importance for monitoring Arctic change.
- Reinvest in North Pacific right whale research by redirecting limited internal funds and, more likely, by attracting external support. This is a critically endangered species that warrants research attention.
- Consider a “user-pays” approach to funding cetacean and other research needs. Alternatively, seek industrial partnerships for supporting moorings, etc.
- Continue to pursue automated approaches to processing acoustics data.
- Pursue resources for surveys, tagging, and acoustics work, all of which are needed to address core stock assessment mandates.
- Explore alternative approaches to providing advice to managers related to stocks that are particularly difficult to assess and/or unlikely to receive sufficient funding support to assess (i.e., alternatives to full-blown population and mortality assessments with associated PBR evaluation).
- Examine alternative methods of obtaining humpback calving ground observations through use of fisher or ecotourism guiding observations.
- The Center should consider approaching the Navy or other potential partners (BOEM, Coast Guard) about their interest in mining the Passive Acoustic

Recorders data set for information about the presence of NPRW, bowheads, fin whales and/or humpback whales near/within chokepoints such as the Bering Strait and Unimak Pass.

- The Center should identify and pursue partners (e.g., Coast Guard, NOS) who might be willing to provide ship support for servicing the Acoustic array this year, and possibly in the longer term.

## **Theme 5: Small Cetacean Science**

### **Observations:**

Like the large cetacean program, the small cetacean research is restricted by a lack of funding by NOAA. There are certain stocks that need additional research efforts (i.e., Cook Inlet beluga), and other widely distributed species (e.g., harbor porpoise) that require broad-based surveys and genetic analyses. After the hunt for Cook Inlet beluga ended in 2005 there has been a slight decrease (-1.3%/year; SE = 0.8%) but not a statistically significant change in the past 15 years. The critical species is the Cook Inlet beluga.

### **Strengths:**

- Studies of killer whales in the western Aleutians have benefitted by the piggy-backing with other studies in the area to make the research possible or more efficient.
- Nice mix of techniques applied to Aleutian killer whale work to evaluate predation pressure, while also gathering data to inform stock assessment and other issues. This provides opportunity to study competition between Steller sea lions and fish eating killer whales for Atka mackerel.
- Tag impacts study underway (being written?) for Southeast Alaska killer whales.
- Long time series of Cook Inlet beluga surveys and Southeast Alaska surveys.
- Fairly extensive acoustic mooring program in Cook Inlet to inform potential noise impacts.
- Good partnerships with academics.

### **Challenges:**

- Lack of samples for harbor porpoise throughout its range in Alaska has not allowed a complete understanding of stock structure, therefore, stock-specific bycatch impacts.
- No plausible hypothesis provided for Cook Inlet Beluga decline or lack of recovery. The research effort does not seem to be driven by the testing and elimination of plausible explanations for the decline.
- Cook Inlet beluga photo-identification catalog developed by LGL apparently is not readily available for mark-recapture work (but should be made so).
- Cook Inlet beluga biopsy and capture programs have faced permitting and other issues (e.g., lack of Regional Office support).

- Without vital rates and other information that would be available from photo-identification catalog, biopsies, and captures – little to no progress will be made in understanding causes of Cook Inlet beluga decline.
- Prey (e.g., salmon) data for Cook Inlet belugas has not been mined. There is the suggestion that these data are not suitable for estimating Cook Inlet beluga prey availability, but it seems that they should provide some information.
- Use the mark-recapture data and a Jolly-Seber model to get an abundance estimate for Cook Inlet beluga.
- Resource limitations resulted in small, but long-term, small cetacean research program in Southeast Alaska. It appears that little stock assessment information has been produced by this program (15 years since last population estimates for harbor porpoise in inland southeast waters), likely because the program focused on different issues throughout the time series.
- Fisheries observer coverage for Alaska state fisheries has always been very poor, and has now been canceled entirely. This is problematic for assessing bycatch of harbor porpoise, Dall's porpoise, seals, etc., that are vulnerable to bycatch particularly in gillnet fisheries.
- Similarly, resource limitations resulted in Aleutian killer whale work focused on predation, although that work was used to also inform stock structure and population estimates (and diet, etc.).

Recommendations to address issue:

- Recommend that the NMML explore further permitting that would allow captures and sampling (e.g., satellite tagging, biopsy, health assessment) of Cook Inlet beluga whales.
- Recommend that NMML further develop collaborations, data mining, or other sampling capabilities to assess prey availability and use (especially for salmon) by Cook Inlet beluga during the summer, and maybe during winter.
- Recommend that when in the western Aleutians, that vessel time be expanded to allow greater effort by the killer whale group to tag and observe this species.
- Recommend that NMML expend greater effort to obtain harbor porpoise samples throughout its range, especially to gather genetics samples that might determine stock structure.
- Keep as a priority the examination of the Dall's porpoise data to determine abundance.
- Gain access to and use the LGL photo-identification catalog for mark-recapture vital rates work.
- Initiate biopsy and capture work on Cook Inlet belugas. This work is vital to understanding the cause(s) of the ongoing population decline.
- Mine existing Cook Inlet fisheries data to inform prey availability for belugas. To the extent these data are not suitable, initiate (or work to have the State initiate) improved fisheries data collection protocols.

- Investigate PCOD (Population Consequences of Disturbance) work and consider similar approaches to estimating impacts of disturbance (i.e., noise) on Cook Inlet belugas.
- Mine data from the Southeast Alaska surveys program to inform other stock assessments, e.g., Dall's porpoise (which apparently is underway).
- Pursue support for bycatch monitoring in particularly risky fisheries and/or regions.
- Pursue potential partnership with OAR and external benefactors to develop methods for analyzing genetics from water samples collected near small cetaceans.
- Leverage resources by conducting joint Steller sea lion, northern fur seal, harbor seal, and killer whale (and perhaps other species as well) along with oceanographic and fisheries research in Western Aleutian Islands.

### **Other Observations: Operational Issues**

With a staff of about 100 individuals (53% permanent) and a large percentage that are reaching retirement age, the NMML needs to be strategic about their future, especially about placing females in program leadership roles.

#### **Strengths:**

- Skilled staff and strong management efforts to control labor costs and ensure some operational funds remain available

#### **Challenges:**

- Balance between temporary and permanent staff and succession planning.
- Scientific research permitting has caused several serious delays and cancellations of research projects.
- Data sharing to meet PARR requirements. Perhaps there is a need for an additional data manager.
- A long-term plan for staffing, balancing labor costs with operational costs while maintaining stable funding.

#### **Recommendations to address issue:**

- Continue to develop succession plans to anticipate and respond to retirements.
- The Center must work within the system to establish as flexible a stance as possible and develop and respond to opportunities as they arise.
- Work with NMFS Office of Protected Resources Permits and Conservation Division to identify challenges and solutions to common permitting issues (which could require changes/actions on the part of both NMML and the Permits and Conservation Division). Such an effort was initiated many years ago. Following up on the findings of that effort would be a good starting point.

- Consider the efficacy of more contract work with non-NOAA researchers, which would allow greater budgetary flexibility and access to a larger pool of expertise and resources.
- NMFS should consider changing the name of the National Marine Mammal Laboratory considering its primary focus is on issues associated with Alaska.

#### Conclusions:

The NMML has an impressive collection of talented and dedicated scientists that have been extremely productive given the constraints of working in Alaska where it is remote, expansive, challenging weather, with an active and engaged Native Alaskan subsistence harvest, and important fisheries. NMML is clearly a center of excellence in survey design and implementation, development and use of novel technologies, and marine environmental statistics. The science NMML conducts is very well targeted to the management needs of the Regional Office and core partners, like BOEM. NMML research seems to be striking a good balance between basic monitoring efforts and studies to understand factors driving population dynamics, given the available resources.

NMML also actively seeks out partners to attract additional resources and leverages those resources. Given the limitations on available resources, NMML leadership, including Program leads, clearly invest in careful planning and prioritization of research efforts to optimize available research platforms and funds. In the current budget climate, we encourage NMML leadership to continue to focus on cross-cutting planning and prioritization, including leveraging resources across programs. Part of this calculus would seem to be evaluation of the relative likelihood of gaining key information to improve stock assessments or to understand factors driving population dynamics, now and/or into the future. In some cases, it may be appropriate to shift resources from well-funded programs to poorly funded programs, if that shift would result in a more substantial gain in key information (recognizing limitations associated with PPA integrity).

Assessment of health parameters appears to intersect with all of the programs, although this aspect was not well discussed, and could be more integrated among all programs. Also given constrained funding this aspect should be re-assessed. There needs to be a good plan regarding human resources to meet the data sharing requirements associated with PARR. NMML needs to have greater flexibility in how it can distribute financial resources, so that it can be nimble and strategic about where funds and research is distributed.

**Reviewer Report on Program Review of Protected Species Science  
Alaska Fisheries Science Center  
16-18 March 2015**

**Reviewer One**

**Key (Specific) Findings and Recommendations (as reviewer has comments on)**

**Theme 1: Information Needs**

- Observations
  - Strengths
    - Clear coordination between Center and Regional Office on identification of scientific information needs to meet management priorities.
    - Formal and informal implementation process to adapt research priorities in coordination/consultation with the Regional Office.
  - Challenges
    - Significant gaps between mandated stock assessments and Center's ability to produce those assessments. Many stocks do not have population or mortality estimates, and many that do have very outdated information.
    - This gap is largely explained by resource limitations and significant (and costly) logistical challenges to assessing many of these stocks, particularly within the very large expanse of Alaskan waters. Some aspects of this gap may also be related to lack of flexibility within federal line-items to support assessments of stocks that are not well funded by directed line-items (i.e., PPAs).
    - Fisheries observer coverage for Alaska state fisheries has always been very poor, and has now been canceled entirely. This is problematic for assessing bycatch for harbor porpoise, Dall's porpoise, seals, etc., that are vulnerable to bycatch particularly in gillnet fisheries.
    - Harvest monitoring has been carried out via co-management agreements and through Alaska Department of Fish and Game. State support for that work is apparently declining, which is problematic for assessing directed mortality of harvested stocks.
    - Significant cost in terms of scientific labor, and associated ability to carry out research, associated with intermittent need to respond to listing petitions (e.g., recent ice seal listing petitions required NMML staff time that might otherwise have been spent carrying out ice seal research).
- Recommendations
  - Explore alternative approaches to providing advice to managers related to stocks that are particularly difficult to assess and/or unlikely to receive sufficient funding

- support to assess (i.e., alternatives to full-blown population and mortality assessments with associated PBR evaluation).
- Develop explicit strategy for assessing all stocks, considering costs, likely available funds, and scientific and management priorities. This could include alternative options for providing advice to managers mentioned above.
- Pursue support for bycatch monitoring in particularly risky fisheries and/or regions.
- Pursue support for harvest monitoring.

## **Theme 2: Otariid Pinniped Science**

- Observations
  - Strengths
    - Well resourced program (particularly Steller sea lion program) with long time-series of quality data in many regions.
    - Science is well targeted to addressing management needs.
    - Strong population dynamics and vital rates program.
    - Strong tagging and movement/habitat analysis program (particularly Northern fur seal program because fur seals show more clear habitat associations).
    - Good development and use of new technologies (e.g., satellite tags, UAS's, remote cameras, aerial survey cameras).
    - Strong analytical capabilities, with particular reference to development of AgTrend analytical tool.
    - Strong publication record.
    - Clearly substantial planning and priority setting to adapt to changing needs and changing resource/logistical issues.
    - Good coordination with partners, including State, Russia, academics, and Alaska Native Organizations (at least for fur seals, work with ANOs with respect to sea lions not discussed).
    - Good efforts to communicate with public via Seattle Aquarium and video.
    - Timely delivery of several products to Regional Office and Fishery Management Council.
  - Challenges
    - Complex systems and very difficult to tease out causes of population trends.
    - Strong political pressures to focus on particular questions and products.
    - Data sharing to meet PARR requirements.
- Recommendations
  - Continue population monitoring and vital rates (marking and resighting) work for both otariids.
  - Continue to invest a reasonable portion of resources in investigating causes of population dynamics, with goal of striking good balance between monitoring

- current status and improving understanding, which in turn should identify ongoing or developing management issues.
- Given flexibility in use of pinniped funding, NMML should consider relative priorities (in terms of science and management) for research spending among the pinniped research programs. For example, given lack of information on ice seals and climate and development threats facing those species, some resources might be shifted to ice seal research from the traditionally better-funded otariid programs.
  - Leverage resources by conducting joint Steller sea lion, northern fur seal, harbor seal, and killer whale (and perhaps other species as well) along with oceanographic and fisheries research efforts in Western Aleutian Islands.
  - Continue to pursue improved communication with the public, taking advantage of charismatic nature of these species.

### **Theme 3: Phocid Pinniped Science**

- Observations
  - Strengths
    - Research targeted to addressing management needs, though significantly constrained by resources.
    - Good coordination with BOEM, State, ANOs, and academics – including state-wide research plans for phocids.
    - Strong development of methods to address ice seal survey challenges (e.g., camera and FLIR systems).
    - Strong development of tag technologies (e.g., flipper satellite tag).
    - Strong habitat density modeling and movement modeling program.
    - Good adaptive survey design/prioritization scheme for harbor seals.
    - Finalized stock structure, which I know was a long process.
    - Improved harbor seal abundance estimation analyses with increased precision, which in turn avoids unnecessary restrictions on subsistence harvest (i.e., higher PBR values).
    - Strong development of partnership with BOEM to support research.
    - Efforts to improve public communications, e.g., via new video.
  - Challenges
    - Limited resources and costly surveys (particularly for ice seals).
    - Difficult to link population dynamics to causes (e.g., understanding likely impact of loss of sea ice on ice seals).
    - Difficult to assess impacts of disturbance on populations (e.g., cruise ship disturbance of harbor seals in glacial fjords), though good efforts to link to individual thermal impacts.
    - Data sharing to meet PARR requirements.
- Recommendations



- Finish ice seal abundance estimates and update SARs.
- Conduct Chukchi/Beaufort surveys for ice seals, particularly important for ringed and bearded seals.
- Conduct additional ice seal surveys in near future to begin to build database to track potential population impacts of loss of sea ice.
- Obtain improved aircraft capabilities for ice seal surveys.
- Continue development of automatic detection processes for FLIR data to improve efficiency of ice seal survey data processing.
- Link ice seal survey and tracking data to habitat variables to investigate habit preferences, potential areas of special importance, and possible impacts of loss of sea ice.
- Continue to focus harbor seal surveys in areas of decline in Western Aleutian Islands.
- Leverage resources by conducting joint Steller sea lion, northern fur seal, harbor seal, and killer whale (and perhaps other species as well) along with oceanographic and fisheries research efforts in Western Aleutian Islands.
- Investigate PCOD (Population Consequences of Disturbance) work on harbor seals and other species and consider similar approaches to estimating impacts of disturbance on seals (e.g., cruise ships in glacial fjords).
- Continue to pursue improved communication with the public, taking advantage of charismatic nature of these species.

#### **Theme 4: Large Cetacean Science**

- Observations
  - Strengths
    - Research targeted to addressing management needs, though significantly constrained by resources.
    - Excellent broad-scale, multi-year research programs (ASAMM, CHAOZ, ARCWEST), supported through strong partnership with BOEM.
    - Long time series of bowhead data via ASAMM and predecessor programs.
    - Good partnerships with Alaska native organizations, academics, Canada, etc.
    - Strong acoustic program.
    - SPLASH program was great and products continue to follow.
    - Tag impacts study very helpful, and rarely done.
    - Very strong publication record.
    - Timely reporting from ASAMM program.
  - Challenges
    - Lack of internal NOAA funding requires reliance on external funding, which can be less dependable (e.g., loss of support for North Pacific right whale research when it was no longer a priority for BOEM).

- Several stocks with uninformative (e.g., missing or out of date data) stock assessments – resulting from lack of resources to carry out research.
- Data sharing to meet PARR requirements.
- Recommendations
  - Continue broad-scale, multi-year research programs – especially ASAMM given its long time series and importance for monitoring Arctic change.
  - Reinvest in North Pacific right whale research by redirecting limited internal funds and, more likely, by attracting external support. This is a critically endangered species that warrants research attention.
  - Consider a “user-pays” approach to funding cetacean and other research needs. For example, by levying fees on development projects and shipping/fishing industries to support research to assure that their activities are not jeopardizing protected species. Alternatively, seek industrial partnerships for supporting moorings, etc.
  - Continue to maintain array of acoustic moorings in Bering, Chukchi and Beaufort. Excellent and irreplaceable source of information.
  - Continue to pursue automated approaches to processing acoustics data. Significant challenges were noted with respect to developing these approaches, but they are still worth pursuing because the payoff in terms of efficiency could be large.
  - Pursue resources for surveys, tagging, and acoustics work, all of which are needed to address core stock assessment mandates.
  - Explore alternative approaches to providing advice to managers related to stocks that are particularly difficult to assess and/or unlikely to receive sufficient funding support to assess (i.e., alternatives to full-blown population and mortality assessments with associated PBR evaluation).
  - Pursue improved communication with the public, taking advantage of charismatic nature of these species.

## **Theme 5: Small Cetacean Sciences**

- Observations
  - Strengths
    - Research generally targeted to addressing management needs, though significantly constrained by resources.
    - Long time series of Cook Inlet beluga surveys and Southeast Alaska surveys.
    - Fairly extensive acoustic mooring program in Cook Inlet to inform potential noise impacts.
    - Nice mix of techniques applied to Aleutian killer whale work to evaluate predation pressure, while also gathering data to inform stock assessment and other issues.
    - Good partnerships with academics, primarily.

- Tag impacts study underway (being written?) for Southeast Alaska killer whales.
- Challenges
  - Cook Inlet beluga photo-identification catalog developed by LGL apparently is not readily available for mark-recapture work (but should be made so).
  - Cook Inlet beluga biopsy and capture programs have faced permitting and other issues (e.g., lack of Regional Office support).
  - Without vital rates and other information that would be available from photo-identification catalog, biopsies, and captures – little to no progress will be made in understanding causes of Cook Inlet beluga decline.
  - Prey (salmon) data for Cook Inlet belugas have not been mined. There is the suggestion that these data are not suitable for estimating Cook Inlet beluga prey availability, but it seems that they should provide some information.
  - Resource limitations resulted in small, but long-term, small cetacean research program in Southeast Alaska. It appears that little stock assessment information has been produced by that program (recent population estimates for harbor porpoise in inland Southeast waters), likely because the program focused on different issues throughout the time series.
  - Resource limitations resulted in Aleutian killer whale work focused on predation, although that work was used to also inform stock structure and population estimates (and diet, etc.).
  - Fisheries observer coverage for Alaska state fisheries has always been very poor, and has now been canceled entirely. This is problematic for assessing bycatch for harbor porpoise, Dall's porpoise, seals, etc., that are vulnerable to bycatch particularly in gillnet fisheries. The limited observer program that was conducted on Southeast Alaska gillnet fisheries highlighted a potential bycatch problem for harbor porpoise.
  - Data sharing to meet PARR requirements.
- Recommendations
  - Gain access to and use the LGL Cook Inlet beluga photo-identification catalog for mark-recapture vital rates work.
  - Initiate biopsy and capture work on Cook Inlet belugas. The successful work on Bristol Bay belugas should support efforts to gain permission to carry out this work on Cook Inlet belugas. This work is vital to understanding the cause(s) of the ongoing population decline.
  - Mine existing Cook Inlet fisheries data to inform prey availability for belugas. To the extent these data are not suitable, initiate (or work to have the State initiate) improved fisheries data collection protocols.

- Investigate PCOD (Population Consequences of Disturbance) work and consider similar approaches to estimating impacts of disturbance (i.e., noise) on Cook Inlet belugas.
- Mine data from the Southeast Alaska surveys program to inform other stock assessments, e.g., Dall's porpoise (which apparently is underway).
- Pursue support for bycatch monitoring in particularly risky fisheries and/or regions.
- Pursue potential partnership with OAR and external benefactors to develop methods for analyzing genetics from water samples collected near small cetaceans.
- Leverage resources by conducting joint Steller sea lion, northern fur seal, harbor seal, and killer whale (and perhaps other species as well) along with oceanographic and fisheries research efforts in Western Aleutian Islands.
- Pursue improved communication with the public, taking advantage of charismatic nature of these species.

#### **Theme 6: Operational Issues**

- Observations
  - Strengths
    - Skilled staff and strong management efforts to control labor costs and ensure some operational funds remain available
  - Challenges
    - Balance between temporary and permanent staff and succession planning.
    - Scientific research permitting has caused several serious delays and cancelations of research
    - Data sharing to meet PARR requirements.
- Recommendations
  - Continue to develop succession plans to anticipate and respond to retirements.
  - Work with NMFS Office of Protected Resources Permits and Conservation Division to identify challenges and solutions to common permitting issues (which could require changes/actions on the part of both NMML and the Permits and Conservation Division). Such an effort was initiated many years ago. Following up on the findings of that effort would be a good starting point.

#### **Conclusions**

NMML hosts an excellent collection of very talented scientists, with excellent publication records, and is clearly a center of excellence in survey design and implementation, development and use of novel technologies, and marine environmental statistics. The science NMML conducts is very well targeted at the management needs of the Regional Office and core partners, like BOEM. NMML research seems to be striking a good balance between basic monitoring efforts and studies to understand factors driving population dynamics, given the available resources. NMML also actively seeks out

partners to attract additional resources and leverages those resources excellently. Given the limitations on available resources, NMML leadership, including Program leads, clearly invest in careful planning and prioritization of research efforts to optimize available research platforms and funds. In the current budget climate, I encourage NMML leadership to continue to focus on cross-cutting planning and prioritization, including leveraging resources across programs. Part of this calculus would seem to be evaluation of the relative likelihood of gaining key information to improve stock assessments or to understand factors driving population dynamics, now and/or into the future. In some cases, it may be appropriate to shift resources from well-funded programs to poorly funded programs, if that shift would result in a more substantial gain in key information (recognizing limitations associated with PPA integrity).

**Reviewer Report on Program Review of Protected Species Science  
Alaska Fisheries Science Center  
16-18 March 2015**

**Reviewer Two**

**Key (Specific) Findings and Recommendations (as reviewer has comments on)**

**Background**

I write this review from the perspective of a statistical ecologist whose knowledge of the mandates, objectives and processes of the National Marine Mammal Laboratory (NMML), Alaska Fisheries Science Center are very limited. That being said, I feel I bring to the table different insights than someone well versed in the operations of NMML and hope that my observations and recommendations can be of some value. I have a background in remote seabird field research both in British Columbia and Alaska so I can appreciate the logistical challenges and budget requirements to do this kind of work. There are five questions that reviewers have been asked to address, my focus is mainly on that of survey design and statistical rigor.

**General Observations and Recommendation**

Over the last 3 days I have enjoyed learning about the programs and research going on at NMML and feel that I have just scratched the surface of what goes on here. It would have been helpful from my perspective to have a brief meeting with the statisticians responsible for the various projects to hear their views on the concerns and challenges.

Overall communication of research in the form of peer review publications is at an impressive rate over all programs areas. I am also seeing evidence of communicating this research to the wider audience through pamphlets and videos for example.

One area I did not hear much about was the anthropogenic effects issue either by bycatch (for many species) or noise. This comes up several times in the Regional needs and I didn't see (in the presentations) anyone attempting to study these effects.

I have heard about and seen very good work coming out of the statisticians.

**Key (Specific) Findings and Recommendations (as reviewer has comments on)**

**Theme 1: Information needs**

*Observations*

- Regional office provided a list of top 10 research needs for protected species, most of which are for marine mammals.
- Internal proposals for research projects are ranked based on agency needs and funding availability.

### *Strengths*

- Most of the list of top 10 needs is being studied by NMML; I will address specifics within the later themes.
- Looks like there is an excellent mix of expertise in both the permanent and non-permanent staff to address the research questions.

### *Challenges*

- Funding for all of the top 10 priorities is extremely limited and often non-existent.
- There are a few projects that are better funded, and it is not clear if better use of these funds can be made through other projects piggybacking and extending collaborations beyond mammal work even.

### *Recommendations to address issue*

- It would seem that at the internal proposal stage, some amount of coordination amongst projects could be made so that more piggybacking could be made (e.g. vessel time, aircraft survey time, etc.).
- Is it possible to collaborate on these things with fisheries researchers, fish and wildlife, etc. to extend piggybacking beyond just this science centre?

## **Theme 2: Otariid pinniped science**

### **a) Steller Sea Lions**

#### *Observations*

- Basic abundance (using pup counts with a correction factor) and trend monitoring is being carried out and this clearly needs to continue.
- Mark-resight studies in the western Aleutians have begun but it is too early to obtain age-class survival information and birth/recruitment rates. Permanent marks are used so there are no tag-loss issues.

#### *Strengths*

- Methods of obtaining abundance estimates and assessing trends have stayed consistent over the years.
- New methods are starting to be used such as the mark-resighting efforts, satellite tags, unmanned aircraft, and digital photography. These are all clear strengths to improve and obtain the overall research objectives.
- Statisticians have developed statistical methods to deal with any missing count information from sites that were missed for logistical reasons.
- Have good mark-resight information (beginning in 2000) on the eastern population. This will provide excellent comparison data to the western and central Aleutian populations.
- Have already looked into various hypotheses as to why there is still a decline in the western populations.
- Community outreach has been done via video on sea lions for example.

#### *Challenges*

- The correction factor is 25 years old and it has been brought up before that it is not known if it is still valid, especially with an unstable population in decline. This correction factor comes with the assumption that population declines over all groups are equal (males, female, juvenile, pups); this assumption needs to be assessed.
- There are permit issues regarding the capture of adult female sea lions restricting the marking to pups. This has led to delays in research projects and findings.

#### *Recommendations to address issue*

- Can already check the correction factor on the eastern population using a Jolly-Seber model to get a second estimator of abundance. Sample sizes might cause a challenge here?
- Once at least 3 years of mark-resight data have been collected, a Jolly-Seber model can be used to obtain an abundance estimate of the pups as well as survival information. Once this study has been ongoing to include different age classes and sex, this will be extremely useful to evaluate the abundance estimator as well as provide the survival rate estimation that is lacking.
- Continue to investigate hypotheses regarding western population decline including prey competition, correlation with changes in bottom-up process (such as plankton, zooplankton), etc.
- I would recommend working with the permit office to promote the implementation of the “Marine Mammal Scientific Permit Process Review Report to the Assistant Administrator for Fisheries” written in 2011. Finding new unique ways to address this issue might be helpful. It seems senseless that two divisions of the same agency have been in conflict this long, ultimately stopping the science from moving forward. I recommend an outside stakeholder or stakeholders get involved with this issue.

### **b) Northern Fur Seals**

#### *Observations*

- Basic abundance (using pup production as an index) and trend monitoring is being carried out.
- Batch marking (using shearing) studies on pups are used combined with a Lincoln-Petersen estimator to obtain an estimate of abundance.
- Double-tag mark-recapture studies (using flipper-tags) have begun on 2 colonies tagging both juveniles and adult females.
- There are permit issues regarding the capture of adult female sea lions restricting the marking to pups. This has led to delays in research projects and findings.

#### *Strengths*

- Using capture-mark-resight models for estimation of survival rates.
- Double tags are used so that tag-loss can be estimated and the new tags that are being used have low tag loss rates.
- Have run simulation studies on the mark-resight models to look at precision for various tag deployment rates.



### *Challenges*

- The correction factor is 25 years old and it has been brought up before that it is not known if it is still valid.

### *Recommendations to address issue*

- Could look at integration of the batch-mark data and the mark-recapture-resight data along the lines of Carl Schwarz's methods or similar to a robust design idea. Could this possibly improve precision of estimators further?
- Could a Schnabel estimator be useful here as batch marking occurs across the season? Would the population be considered closed during this time frame?
- Could make use of extended batch marking modelling if different types of shearing marks could be put on at each sampling occasion. Covariates such as colony for example could be incorporated to improve model estimates. This would allow for open population assumptions.
- Once data demands are sufficient, use a Jolly-Seber estimator to obtain an abundance estimate to determine if the pup index estimator is inline with the mark-recapture models.

## **Theme 3: Phocid pinniped science**

### **a) Ice-seals**

#### *Observations*

- Four seals are being monitored: bearded, ring, spotted, ribbon.
- Artic monies for research are all reimbursable (BOEM major partner)
- Artic is quickly being developed, partly due to polar ice cap reduction. Need to get baseline assessments done so that there is a set up for Before After Control Impact (BACI) studies can be done for large-scale projects.

#### *Strengths*

- Started using infrared cameras paired with colour video cameras to increase detection.
- Using a Bayesian spatial hierarchical regression model with covariates to obtain estimates of abundance, making good use of the statisticians involved.

#### *Challenges*

- Widely dispersed so can't get good abundance estimate due to detection issues.
- Species identification is difficult in aerial surveys.
- Difficult location for aerial surveys in small (less expensive planes).
- Data from cameras is immense and difficult to catalogue and process.

#### *Recommendations to address issue*

- Secure funding for larger plane so that more time is spent surveying and less time is spent flying to/from transect sites.
- Hire a data manager.

## **b) Harbor Seals**

### *Observations*

- Several population of interest: Iliamna Lake, eastern Alaska, and western/Aleutian Alaska.
- Historically have used design based methods with transect data.
- Concerns about cruise industry impacts in glacial fjord areas.

### *Strengths*

- Prioritize transects so that estimates are being made under the current funding limitations. Priority is in areas where there are historical numbers.
- Developed a Bayesian model for the counts that inflates variances estimates in areas where there is less effort.
- Community outreach has been done via video on ice-seals for example.

### *Challenges*

- No funding to further study the impact of cruise ships on harbor seals in the glacial fjord areas.
- Spatial use data has not been linked to environmental data to identify habitat- this will affect where data collection is focussed on future surveys.
- Do not have decent data on the Aleutian and Iliamna stocks.

### *Recommendations to address issue*

- Could implement a rotating panel survey design, and indeed it sounds like something similar has been implemented where colonies (or transects) of interest move in and out of the survey depending on priority. These study designs are also useful if and impact needs to be assessed. Panel surveys reduce variances estimates compared with traditional designs. I would think that it is also important that non-priority colonies be surveyed to capture any shifts in habitat use.
- Collaborate with cruise ship companies (perhaps user fees for example) to begin research on the effects of cruise ships on harbour seals. Ideally a BACI design would be implemented here. Do you have historical data on these populations before cruise ships? If not, certainly control sites should be monitored to control for confounding variables.
- To obtain surveys for the Aleutian stocks, can piggybacking occur with the Sea Lion surveys for example?

## **Theme 4: Large cetacean science**

### *Observations*

- Impact on right whales during the 20<sup>th</sup> century due to illegal whaling was massive. Now left with approximately 30 individuals.
- Concern that shipping lanes will open up in the artic due to melting sea ice; this will put right whales at risk as it passes through their territory.
- Humpback wales have recovered well and are looking at delisting. More monitoring needs to be done.

### *Strengths*

- Long term (35 year) aerial surveys are in place, it is important to continue this data.
- Passive acoustic recorders have been shown to be extremely useful in monitoring multiple species and possibly different populations through song variability. Obtain information on distribution and occurrence.
- Have discovered through SPLASH that there is likely a missing calving ground for humpbacks.

### *Challenges*

- No good population estimate for the western population right whales, collaborations with Russia to study this will likely be difficult.
- No idea where breeding ground is, thus satellite tagging should continue, although it is extremely difficult to find and tag these individuals.
- SPLASH funding is finished and there is little interest from collaborators in finding the humpback calving ground.

### *Recommendations to address issue*

- Determine if it is feasible to use passive acoustic recorders for an occupancy study to try to find breeding grounds of right whales (through a simulation study for example).
- Look into the possibility of donating technology so that western stocks in Russia can be studied. Try to negotiate with arctic governments to have research collaborations.
- Look at alternative methods of obtaining humpback calving ground observations through use of fisher or ecotourism guiding observations. This possibly could be web-based and would provide a starting place for research when funds did come through. Collaborations with an academic institute could be a good route to turn this into a very low cost student-based project.

## **Theme 5: Small cetacean science**

### **a) Beluga Whales**

#### *Observations*

- No hunt since 2005 in Cook Inlet yet stock has not recovered and does not appear to be increasing.
- Primarily interested in abundance and trends.
- No vital rates data obtained yet.
- Trend since 1999 is -1.3%/year (se=0.8%). A quick confidence interval calculation here includes a rate of 0% is plausible, thus is this population really decreasing or has it stabilized for some reason?

#### *Strengths*

- Working with LGL on a mark-recapture photo-id study to obtain estimates of survival rates.

### *Challenges*

- The photo-id mark-recapture data has been collected (since 2009), but LGL has not released it due to data cleaning issues.
- Annual surveys have moved to biennial surveys due to funding cuts.
- Problems getting permits to capture beluga whales has stopped some of the Cook Inlet research.

### *Recommendations to address issue*

- Offer LGL person-time to help get the photo-id data to a useable state. This is one resource you do have!
- Use the mark-recapture data and a Jolly-Seber model to get an abundance estimate. This might prove difficult with small sample sizes, but it is worth a try, especially since there are now multiple years of data.
- LGL-Sidney just hired a statistical ecologist last year (Dr. Wendell Challenger), get him interested in the photo-id project and get moving on the collaboration.

## **b) Killer Whales**

### *Observations*

- No current regional requirements for orcas in their top 10 list.
- Attempts are being made to study both the transient and resident populations of both eastern and western Alaska.
- Links have been made with the sea lion studies to see if transients have made impacts of predation.
- Produced both line transect and mark-recapture estimate of western Aleutian population size.
- Different types of orcas doing massive 3-week rapid migrations south, and then returning to Aleutians.

### *Strengths*

- Piggybacking research on Aleutian transients on Steller sea lion cruises.
- SE Alaska population has been well studied and have 25 years worth of data through vessel surveys, photo id, and satellite tags.
- Piggybacking research on SE Alaska population on harbor porpoise research.

### *Challenges*

- Always funding.
- 

### *Recommendations to address issue*

- None.

## **c) Harbor Porpoise**

### *Observations*

- Last abundance estimate is now 15 years old.
- Looking at stock structure studies through biopsied genetic data.

- Most recent data is only coming from inland water population.

#### *Strengths*

- Long-term survey of SE inland stock

#### *Challenges*

- Funding for aerial and vessel surveys to get basic abundance and trends for all stocks.

#### *Recommendations to address issue*

- Find a way to update the 15-year-old abundance estimate.
- Initiate surveys of other stocks, perhaps via piggybacking operations of other species.
- Would be worth doing a small pilot study to determine the genetic variability. Could use biopsy samples already collected from entangled or stranded porpoises. Use these estimates for sample size calculations to see if a full-scale study is possible.

### **Theme 6: Operational issues**

#### *Observations*

- Approximately 100 staff altogether, 53% permanent.
- In next 5 years, a large percentage will be >60 years old or retired.
- The only real hire I have heard that is needed immediately is a data manager.
- I have noticed that men hold almost all supervisory positions. In an area of the sciences that is heavily studied by females (and not all are), I wonder why this is so. Are women with the right qualifications not applying for the few positions that are there or have gender biases occurred over the years?

#### *Strengths*

- Excellent competent people have been hired in all divisions. I have heard a lot of praise for the 5 statisticians who are coming up with new statistical methods to deal with data challenges.

#### *Recommendations to address issue*

- A long term staffing plan needs to be developed to address balance between labour costs and research costs. What should this balance look like and how are you going to maintain research quality? How will you attract strong new researchers?

**Reviewer Report on Program Review of Protected Species Science  
Alaska Fisheries Science Center  
16-18 March 2015**

**Reviewer Three**

**Key (Specific) Findings and Recommendations (as reviewer has comments on)**

The Alaska Fisheries Science Center (the Center) convened a panel of five independent scientists to undertake a review of its marine mammal program (undertaken by the National Marine Mammal Laboratory – NMML) during March 16-20, 2015. Public sessions took place during the first three days that provided background according to the six themes of the agenda and provided opportunities for panel members and the public to ask questions and make comments. Two days of private sessions then enabled the panel to seek further input, ask and address other questions, prepare independent reports and brief Center leadership. Based on the terms of reference, the overall goal of the review was to “...evaluate the quality, relevance, and performance of science and research conducted in NMFS Science Centers and associated laboratories.” The following comments are in accord with the format recommended in the terms of reference.

**Theme I. Information Needs**

Observations

Strengths

Planning. An apparent strength is the high degree of coordination between the Center and the Alaska Regional Office (the Region) in long- and short-term planning. For example, the Region’s list of top ten marine mammal priorities identifies the science required to backstop its current and future management needs. By the same token, however, the Center Director’s annual guidance document does not explicitly cross-walk with the Region’s list. Such a cross-walk would be a valuable tool to assist any future reviewers when judging the relevance of the science and research undertaken.

Coordination with BOEM. During presentations and subsequent discussion, it was repeatedly stated that BOEM has become a major source of stable funding for NMML. In an era of austere funding of government agencies, this is a strength as it has been an excellent means of retaining valued staff, as well as funding field programs, provided that leadership can assure the relevance of this external support to the Region’s information needs. Since the Region, Center and NMML are so strongly linked together in their joint planning with BOEM, it is very apparent that this concern is well addressed.

## Weaknesses

Lack of internal coordination. With regard to Stellar sea lions, there is need to tease apart the effects of fishing and the possible effects of natural factors, such as regime shift, predation by killer whales and/or competition for prey like Atka mackerel. It would seem useful to apply other sources of expertise to these questions that may be available within the Center (other Divisions), or parts of NOAA (PMEL). Although some examples of fortuitous cooperation were mentioned, it is not clear that formal planning in this regard is happening.

Lack of updated estimates of abundance. The Region's list of priorities does not include the need to update estimates of abundance used for PBR estimates. Current estimates apparently are not available for many of the 45 stocks so assessed, some being 5-10 years old.

## Recommendations

Since the current 5-year plan lapses at the end of 2015, the Region and Center should review and revise the plan as needed for application to the 2016-2020 period, as well as reconsider the list of high priority information needs.

The Center should evaluate the within-house or within-NOAA availability of oceanographic and/or predator/prey expertise that could assist with research on Stellar sea lion issues and develop a plan for coordinating these assets, where possible.

The Center should review the list of out-of-date estimates of abundance used for PBR assessments, determine their priority order and work with the Region to develop the means for updating them.

## **Theme II. Otariid pinniped research.**

### Observations

### Strengths

Extremely strong bio-statistical expertise. The team of quantitative analysts has deservedly won leadership's accolades for pushing the envelope on methodology and successfully applying it to the large data-sets being accumulated by the pinniped research group.

Effective collaboration with outside partners. The use of and coordination with external partners appears to have been especially effective, bringing to bear needed expertise, data sources and other research capabilities.

With regard to northern fur seals, there is a lengthy historical data base, including bull counts from the 1900s and pup counts from the late 1940s.

## Weaknesses

Lack of data from the Western and Central Aleutians. Given the disparate recovery responses of Western-Central stocks of Stellar sea lions versus Eastern Aleutian-Gulf of Alaska stocks, there is need to enhance recently started research efforts in the Western-Central Aleutians.

Lack of data from Bogoslof Island. Given the disparate recovery response of Bogoslof Island versus St. Paul and St. George Islands, there is need to enhance recently started research efforts on Bogoslof Is.

With regard to northern fur seals, there has been a lack of data on vital rates.

## Recommendations

For Stellar sea lions, the Center should urgently continue and strengthen its research efforts in the Western and Central Aleutians, paving the way for comparative studies of the very different recovery response in these two areas. Such comparative studies might give new insights into the factors controlling Stellar sea lion population dynamics.

For northern fur seals, the Center should urgently continue and enhance its research efforts at Bogoslof Island, making possible comparative studies of the disparate recovery response of this population and giving insights into the population dynamics of northern fur seals.

For northern fur seals, the Center must continue and enhance its vital rates studies on all 3 islands.

Regarding both species, the Center should continue its examination of hexacopters and other UAVs given their relative low cost and applicability to difficult weather/terrain situations. For example, one might look at the efficacy of flying them off survey vessels or smaller craft.

## **Theme III. Phocid pinniped science**

### Observations

### Strengths

Effective collaboration with outside partners. The use of and coordination with external partners, especially Alaska Native groups and BOEM, appears to have been especially effective, bringing to bear needed access, expertise, data sources and other research capabilities.



Extremely strong bio-statistical expertise. The team of quantitative analysts has deservedly won leadership's accolades for pushing the envelope on methodology and successfully applying it to the large aerial survey and satellite tracking data sets being accumulated by the pinniped research group.

Development of effective aerial survey methodology. The development of the downward looking , automated 3-camera system has greatly enhanced the accuracy and precision of counts and resulting estimates.

### Weaknesses

Lack of data manager. The lack of a staff member explicitly dedicated to managing the extremely large data-sets generated by aerial surveys and satellite tracking is hampering efforts to meet new directives for making data publicly available, as well as delaying their timely analysis.

Costs of aerial surveys. Aerial surveys still require costly aircraft time, are labor intensive and expose field personnel to risk when flying in the near-Arctic areas.

Lack of automation in the analysis of aerial survey data. Analyzing the photographs is labor-intensive, time consuming and thus expensive.

Regarding ice seals, no trend analysis is yet available. To undertake a trend analysis would require a repeated series of population estimates.

Regarding ice seals, a lack of coordination amongst groups doing satellite tagging. Such coordination is needed to avoid costly duplication of efforts or excessive harassment of seals.

### Recommendations

The Center should follow-through on plans to hire a new data manager.

The Center should work with OMAO to obtain a King Air aircraft that would increase the safety and other capabilities of the aerial surveys.

The Center should consider using the Ice Seal Committee to address the issue of coordinating satellite tagging efforts.

The Center needs to explore methods for automating photo analysis, e.g., adapting facial recognition software or automated plankton sorting methods.

The Center should pursue with the USFWS undertaking a possible polar bear aerial survey in the Chukchi Sea, applying NMML's camera system and data analysis, and leveraging that to get ice seal data as well.

## **Theme IV. Large Cetacean science**

### **Observations**

#### **Strengths**

Relatively stable funding provided by BOEM. BOEM recognizes the value of long term and process-oriented studies, thus providing for a broad-based field effort, albeit at a modest level, in areas of BOEM interest.

Commitments by leadership and staff to collaboration and multi-disciplinary studies. These views make possible access to expertise, datasets and assets that otherwise would not be available, as well as a commendable publication record.

Use of passive acoustic recorders (PAR). PARs provide a cost-effective approach to collecting information on temporal-spatial habitat use and relative abundance of cetaceans and pinnipeds.

An existing PARs dataset. A 7-8 year series already exists that has not yet been fully analyzed and could be mined for information on habitat use.

Successful development of an implantable satellite tag. The new design greatly improves retention time and is now available off-the-shelf.

#### **Weaknesses**

Lack of ship time. The ability to focus on the highest priority North Pacific right whale (NPRW) is severely hampered.

#### **Recommendations**

The Center should consider approaching the Navy or other potential partners (BOEM, Coast Guard) about their interest in mining the PARs data set for information about the presence of NPRW, bowheads, fin whales and/or humpback whales near/within chokepoints such as the Bering Strait and Unimak Pass. Such data would assist in analyzing the threat posed by the possibility of increased ship traffic through those areas as global warming diminishes sea ice.

The Center should identify and pursue partners (e.g. Coast Guard, NOS) who might be willing to provide ship support for servicing the Acoustic array this year, and possibly in the longer term.

## **Theme V. Small cetacean science**

### Observations

#### Strengths

Abundance and trends are known for Cook Inlet belugas (CIB). This activity provides strong evidence of a continuing decline, despite the cessation of the subsistence harvest as the major stressor.

For Aleutian killer whales, research efforts appropriately focused. The Center has focused its research efforts on the Western and Central Aleutians where Stellar sea lions are declining. This provides opportunity to study competition between Stellars and fish eating killer whales for Atka mackerel.

#### Weaknesses

No plausible hypothesis for CIB decline. The research effort does not seem to be driven by the testing and elimination of plausible explanations for the decline. For example, what is the dependence of CIB upon salmon runs and what have been their trends over the period of the CIB decline? What are other plausible explanations?

Data on CIB vital rates are lacking. What are CIB pregnancy rates and how are they behaving over time?

The LGL photo-ID data for CIB have not been analyzed. These data need to be mined to see if they could provide abundance estimates and trends, calving intervals and other vital information.

Winter feeding behavior for CIB is unknown. This information is essential for determining the importance of summer foraging.

For killer whales, there is need for satellite tagging and stable isotope work. Such research would elucidate killer whale feeding behavior and the potential for its competition with Stellar sea lions for Atka mackerel.

For SE Alaska harbor porpoise, uncertainty in estimated bycatch. This issue is confounded by the demise of the observer program formerly funded by the State of Alaska.

#### Recommendations

The Center needs to go back and reexamine the available data on trends in salmon abundance or other prey resources, the CIB's habitat contraction and the potential impact of these factors on CIB.

The Center urgently needs to implement the proposed biopsy survey for CIB.

The Center needs to approach LGL/North Pacific Research Board about analyzing the photo-ID dataset for CIB and jointly identifying possible ways/means for doing so.

The Center needs to implement efforts to obtain satellite tagging and stable isotope data that could provide important insights into possible competition between killer whales and Stellar sea lions for Atka mackerel.

The Center needs to work with the Region to re-examine the harbor porpoise bycatch estimator and provide a scientifically sound basis for it.

## **Theme VI. Operational issues**

### Observations

Strengths - Many have already been elucidated for the individual themes, particularly the strong bio-statistical capability and the strong coordination/collaboration with partners.

### Weaknesses

Public Access to Research Results. Accommodating this new initiative raises challenges but the Center seems to have risen to them. The hiring of a new data manager will help greatly.

Maintaining stable funding and retaining a talented and productive work force.

### Recommendations

The Center must work within the system to establish as flexible a stance as possible and develop and respond to opportunities as they arise.

The Center must look ahead and identify strategic opportunities, and plan and staff up to meet them.

**Reviewer Report on Program Review of Protected Species Science  
Alaska Fisheries Science Center  
16-18 March 2015**

**Reviewer Four**

**Key (Specific) Findings and Recommendations (as reviewer has comments on)**

**Background**

The Alaska Fisheries Science Center's protected species science focuses on cetaceans and pinnipeds. In this review the Review Panel addressed species using ecosystems in Alaska. The Center's research on pinnipeds in the California Current will be addressed in the review of marine mammal and turtle science conducted by the SW and NW Fisheries Science Centers. Currently, there are no listed fish species in Alaska. For context, the marine mammal science program constitutes about 20 % (30 of 150 activity plans) of the science activities of the Center. The Panel was advised to consider comments within the context of level of funding of the Center for the next several years, and that to maintain a reasonable operational budget the Center would be reducing net staffing level by several positions over the next year.

**General Observations and Recommendation**

It is clear that scientists in Division spent a large amount of time preparing for this review and I commend their efforts. The presentations overall were well presented, had the right level of information and a consistent format. I appreciated these attributes as a reviewer. At the conclusions of the presentations and question and answer sessions I came away with good understanding of the research conducted, the rationale underpinning the science and current constraints and strengths of the research programs. My overall observations are that the Division is strong on survey methods, developing and adapting electronic instrumentation, applying state-of-the-art acoustics technology, publishing on their research in a timely and has an excellent team of statisticians working at the forefront to gain as much as possible from the data being collected and by mining existing data. I also concluded that there is a solid relationship between the Center and Alaska Region with consistent and timely communication on management needs, and that the Center and Division leadership was responsive to the management needs. An area that was less clear to me was how decisions are made on what the Region funds for Division science activities. I commend that there is such a relationship and encourage continued partnership to address decision-critical science in an increasingly transparent manner. It appears the proper separation between management and science is being maintained, and suspect that will continue into the future. I also want to highlight the positive benefits of the partnership with BOEM in addressing mutually important mission critical science needs, and that such partnerships can last for many years if well-

constructed. In times of flat or shrinking budgets it is critical to take a proactive and strategic approach to building mutually beneficial partnerships with other federal agencies where there are shared mission needs.

The following are recommendations that cut across the programs/themes reviewed.

- ✓ I encourage the Center to continue to build a strong relationship with BOEM and engage in an internal strategic exercise to define a strategy for the next few years to identify and pursue partnerships with other federal agencies identified as a potential partner with shared mission objectives. This clearly is a need for large whale studies as that program has minimal to no annual operational funds other than what could be called special projects.
- ✓ From the presentations I sensed that there is some cross Center engagement on projects, but the level of cross Divisional team effort on projects appeared minimal. Given the complexity of many of the issues and constrained budgets I strongly encourage that pursuit of more formal collaboration with scientists from other Divisions of the Alaska Center where practical. .
- ✓ It is my recommendation that the Center strongly consider renaming the Division. The science by the Division is outstanding and is appropriately focused on Alaska ecosystem issues, as such the mission of the Division is not national. To more accurately reflect the mission of the Division national should be dropped from the title.
- ✓ I support the efforts to focus research efforts in the western Aleutian Islands across species, to the extent practicable. It is clearly an area of management interest as well as an area that ecologically is quite different from even other sub regions of the Aleutian Islands. I recognize the logistical challenges, nonetheless comparing and contrasting between say the western and central Aleutian Islands may provide valuable insights into the cause for slow to weak recovery/population growth of, for example, pinnipeds in the western region.

## **Key (Specific) Findings and Recommendations (as reviewer has comments on)**

### **Theme 1 – Information Needs**

*Observations, Strengths and Challenges* – The interactions between the Center and the Regional Office appear to be working well and there is good communication. There also appears to be priority setting but it was not exactly clear how that occurs and how formal. Again I am not implying that there is anything broken, only that perhaps a bit more formal cross walk between management needs and research activities could further focus the research and insure that the most important decision critical science is being done. Nonetheless, it is critically important that there is a balance between research/technical advice on short term management needs and mid- to long-term science to address critical uncertainties and to move the state of

understanding forward such that science advice to management in the future has moved to a new level.

For effective management is central that the required data are available for stock assessments. As in other regions there are serious gaps in data. In Alaska the lack of adequate data on bycatch of marine mammals and on subsistence is currently severely restricting conducting stock assessments under the current framework.

Recommendations to address issues:

- ✓ Consider developing a bit more formal process to cross-walk management needs and science activities at the Center.
- ✓ There is a clear need for improved data on bycatch and subsistence harvest. Because it may not be possible to improve substantively data for stock assessments, it may also be of value to consider a workshop, national in scope, to explore alternative framework to the current one based on PBR.

## **Theme 2 – Otariid Pinniped Science**

*Observations, Strengths and Challenges* – Overall the pinniped science is outstanding to very strong at the Alaska Center. It is clear that the primary objective should be Steller sea lion research and that a core need is maintaining adequate survey coverage for developing abundance status and trends particularly in the Aleutian Islands. It was also clear that additional funding would be needed to do the scale of process research to address the critical uncertainties of why the western Aleutian Island stock is not recovering. For example, observations suggest that oceanographic conditions in the western Aleutians are distinct for the rest of the island chain, and recent data for more one species indicates that an oceanographic regime should be considered as a hypothesis for lack of recovery. Clearly, however this is not the only hypothesis and there are others to consider as well, such as competition and predation.

Steps are being taken to do what is possible to address the hypotheses for a slow recovery of Steller's in the western Aleutians. But there is the recognition that the research to determine cause must not compromise the need to have better information on Steller vital rates. The overarching challenge is that of logistics in carrying out research in an area as remote as the western Aleutian Islands. The logistical challenges exist and the team appears to be dealing with them as creatively as possible. An example is the development and deployment of remote camera systems that can monitor rookeries for long periods of time, and the successful exploratory use of UAS (e.g., hexacopters) to survey rookeries when it would not be possible to do so by air due environmental conditions.

I was not able to be present for the presentation on northern fur seals and will not comment specifically on this species. The research on harbor seals is evolving in a positive direction such as moving to a fixed survey units and balancing the need to focus on western Aleutian Islands while not losing sight of the need to maintain survey effort to maintain adequate time series on abundance and trend of the 12

stocks of harbor seals. The new survey design allows allocating more time to areas of high density and for annual abundance estimates even if the entire range is not surveyed annually.

For all pinniped species discussed health and condition data is being collected and the overall approach is generally sound. However, there does not appear to be highly focused research objectives. In a time of constrained resources perhaps this needs to be re-assessed. Related is that there appears to be a general gap in genetic data and that there is only minimal genetic based population structure information for most species. For example, the genetic information for harbor seals does not allow for identification of the stock of origin of subsistence harvested seals. The concern is that when harvested the seals are distributed and thus there is a mixed stock structure, which appears to introduce uncertainty on whether or not there is good information on the actual level of harvest of individual stocks.

Recommendations to address issues: (see below, combined with Phocids)

### **Theme 3 – Phocid pinniped science**

*Observations, Strengths and Challenges* – The research on ice-associated seals is very strong. The use of spatial modeling in developing the current survey design and development and use of FLIR in conjunction with high resolution digital photography has clearly advanced both the accuracy and precision of the survey. Moreover the use of satellite tags in conjunction with flipper tags has substantively improved the understanding of movement and habitat use. But again the real bottleneck to the use of tagging technology is not the tags but rather the ship time to get access to the seals. Nonetheless, the team is developing much improved abundance estimates, but is constrained in their ability to address mechanistic questions, such as the effect of the loss of sea ice on the viability of ice seals.

Recommendations to address issues (Otariid and Phocid pinnipeds):

- ✓ Continue to maintain survey effort to produce abundance estimates at the desired time interval, as well as, complete abundance estimates for the remaining ice seal species.
- ✓ Collecting vital rates for many pinniped species should be a high priority. Collecting vital rate data on Steller's in the western Aleutian Islands are particularly important and the efforts underway should be maintained and expanded. These data are essential to determining the likely causal factor for the lack of recovery for this stock.
- ✓ To the extent practicable, actively assess whether an oceanographic regime shift has occurred and if it could be impeding recovery of Steller's in the western Aleutian Islands.
- ✓ Endorse the adding a data manager to the team to stay abreast of the expanding size and complexity of the data sets.



- ✓ Consider re-assessment of the health/condition research to determine if there are efficiencies or increased productivity if there is rotating effort. The approach could be to focus on a species, species complex, or region (e.g., western Aleutian Islands) for a period of time and then shift to another. It was my sense that there was not a ‘critical mass’ of effort to make substantive progress on any single species with the current distributed approach.
- ✓ In all species the tagging studies on movement and habitat use are clearly yielding important information and should be continued to the extent practicable given the various logistical constraints.

#### **Theme 4 – Large cetacean science**

*Observations, Strengths and Challenges* – The team is carrying out excellent research with a high degree of creativity and ingenuity given the constraint of currently having no operational funds from the agency. They are to be commended for developing partnerships to conduct an impressive mix of retrospective studies and current fieldwork, including maintaining a long times series on bowheads. Notwithstanding, there is risk that they will not be able to maintain and service the current passive acoustic array in the Bering sea maintained in collaboration with PMEL. The limited ship time is the causative factor. It is clear that the passive acoustic data has provided valuable information and that continued analysis of even the existing data will yield information on additional large whale species (at present 3 to 5 years of the 7 year times series of data has been analyzed). The technology itself is relatively inexpensive when deployed and the data retrieved is substantial, therefore, the effort to maintain the passive acoustic monitoring is clearly worthwhile.

The team has prioritized their research effort on North Pacific right whales due to their critically endangered status, which I agree is the proper choice. However, the ability to continue the research is not clear given the lack of funds and high cost of needed studies. For example, the case was made for value of tagging right whales, regardless of the challenge of doing so when they are encountered as individual whales, but the estimate is that at a minimum 3 weeks of ship time would be needed.

Another species of interest is humpback whales. The species overall is healthy and growing at 5 – 7 % a year. The need for current research is not high; however there is minimal information on stock structure. It is possible to improve knowledge of stock structure by analyzing the existing samples from the SPLASH program.

Recommendations to address issues:

- ✓ Continue to pursue partnerships to allow maintenance of the passive acoustic moorings in the Bering Sea, and continue the analyses of the existing acoustic data.
- ✓ A high priority should be a ship based survey for North Pacific right whales covering the Bering Sea and Gulf of Alaska.

- ✓ Work with NMFS headquarters to identify a means to fund the genetic analyses of the archived humpback SPLASH samples to improve information on stock structure. The issue is that no one region ‘owns’ the issue since humpbacks are widely distributed. Putting effort into finding a solution could lead to an approach to address future similar situations faced by NMFS.

## **Theme 5 – Small cetacean science**

*Observations, Strengths and Challenges* – Under this theme the Panel heard of research on belugas, killer whales and harbor porpoise. For beluga’s the Cook Inlet stock is receiving the most attention and should be a stock of concern given the slow decline or minimal recovery in stock abundance. There is also research on the health and condition of belugas in Bristol Bay, which seems to be an opportunistic study rather than of high management need. The research to date on the Cook Inlet stock has focused on annual abundance estimates to monitor status and trends. While clearly important and needed for management abundance monitoring cannot get at the mechanism for the decline or why recovery is not occurring given that subsistence harvest has been sharply reduced from a level that was likely > 10% of the population per year at the highest harvest rate to minimal harvest now. The need for a biopsy program is clearly needed as is looking into the relationship of summer prey over time, even though that may be a challenge. It was noted that the data on major summer prey, salmon, is incomplete. In addition, more attention to winter prey and feeding may be warranted, even if the current hypothesis is that summer feeding provides sufficient reserves to make it through the winter. There does not appear to be any analysis to estimate whether poor summer feeding (e.g., low quality prey) coupled with poor winter prey availability would lead to physiological stress.

The research on killer whales has clearly progressed in recent years to better define global stock structure and species/sub-species delineation, feeding ecology of both resident and transient killer whales, and abundance of transients around the Aleutian Islands and in the Gulf of Alaska, for example. In particular, I fully endorse the approach taken to better understand the ecological role of killer whales in the central and western Aleutian Islands and the integration of the killer whale studies with the Steller sea lion research in the same regions. The combination of tagging, feeding ecology studies, estimating abundance and stock structure has led to a viable new hypothesis that perhaps competition between resident killer whales and Steller’s may be contributing to the lack of recovery of the western Aleutian Island stock of Steller’s. Moreover, the passive acoustic data indicating that in the winter transient killer whales are regularly around Steller rookeries would suggest that it is not possible to dismiss the hypothesis that predation is contributing to the lack of recovery. Further the killer whale studies have shown the value of integrating genetic studies with chemical contaminant, fatty acid and stable isotope studies can be quite powerful in further delineating both stock structure and feeding ecology that it is not possible by using any subset of these measurements.

The survey and abundance estimates on harbor porpoise serve to highlight the broader issue for many small cetaceans that they are receiving inadequate attention. Additionally the lack of resources means the survey design is driven primarily by opportunity and availability of platforms to piggy back survey work. For harbor porpoise in SE Alaska this was manifested by the fact that only a portion of the range for the stock could be surveyed over time. In addition the time series is patchy over time which makes it difficult to interpret. Moreover, there is inadequate stock structure data, which is fundamental information for effective management. The long term research goal is to better access stock structure; however, while it is desired to collect biopsy samples it is not easy on species like harbor porpoise. The initial effort on stock structure will be to analyze archived samples from stranded animals. The sample size (about 85) is likely quite inadequate. I also support the effort to further analyze the survey data to estimate abundance of Dall's porpoise.

Recommendations to address issues:

- ✓ I strongly encourage that a biopsy project for Cook Inlet beluga be initiated at the earliest possible date. It is essential to address critical uncertainties around mechanism for the slow recovery from the sharp reduction in subsistence harvest.
- ✓ Exploring whether there is large variation in salmon prey availability over the current time series for Cook Inlet beluga is worth considering. I heard that there is concern about the quality of existing salmon data, which could limit any meaningful analysis. However, perhaps consulting with ecologists in other west coast centers that have dealt with 'patchy' salmon data could reveal a path worth pursuing.
- ✓ Continue integrating the killer whale work with the Steller sea lion work in the central and western Aleutian Islands and in particular continue the tagging work and explore further means to expand the feeding ecology studies based on stable isotope, fatty acid and chemical contaminant analyses.
- ✓ Keep as a priority analysis of existing survey data to assess Dall's porpoise abundance in SE Alaska

## Conclusions

The high quality of the science and the strength of the science teams and individual scientists in the Division are quite impressive. The initiative to recruit and retain a critical mass of statisticians working at the cutting edge of statistical theory has had a major positive effect on the science enterprise of the Division. All the teams have used ingenuity, creativity and a 'can do' attitude in these fiscally challenging times that collectively makes for a very strong and productive marine mammal science team addressing key management in Alaskan ecosystems. The high level of productivity given the logistic challenges of a vast geography, limited windows for operations given weather, and the challenges of just having researchers on station is testament to the

collective skills of the teams. As noted the development of partnerships is to be commended and to be encouraged into the future. The relationship with BOEM I'm sure will be nurtured in a manner that should lead to long-term mutually productive partnership. The science program appears to have the proper balance between core missions of survey and monitoring efforts and targeted process studies to gain improved understanding of mechanisms driving population dynamics.

This review has further highlighted that in these times of tight fiscal conditions collaboration and coordination with effective planning and prioritization is essential in getting the most out of operational resources. The Center and Division leadership certainly appears to be meeting the challenge, and effectively communicating and coordinating with the Alaska Regional Office.

Taking advantage of opportunities to more closely coordinate and collaborate within the Alaska Center should also be pursued as well as with other West Coast Centers where collaboration is programmatically advantageous. This approach also extends to headquarters to insure that efficient and effective processes are in place to advance in a timely way mission critical surveys and process studies.